Limited Visual Dam Safety Inspection Summary Report

HI - 00027

E-13 Reservoir

Hawaii, Hawaii

Prepared by:

U.S. ARMY CORPS OF ENGINEERS
HONOLULU ENGINEER DISTRICT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

May 2006

Dam ID: HI00027
Name: E-13 Reservoir

Limited Visual Dam Safety Inspection Conducted on: 6 April 2006

I. Purpose:

Due to disaster occurrences of periodic heavy rains and flooding, which has caused extensive damage to property and loss of lives, the Governor has issued a State of Emergency Proclamation extending from February 20, 2006 to April 9, 2006. In light of the tragic failure of the Kaloko dam on Kauai and the continued forecast of heavy rains, emergency inspections of all regulated dams in all counties are being undertaken.

These inspections are for the purpose of determining if any of the regulated dams and reservoirs in the City and County of Honolulu, Maui County or Hawaii County, are suspect for immediate concern to the downstream area under the prolonged conditions of heavy rain showers.

II. Authority

Inspections were authorized under the Hawaii Dam Safety Act of 1987, Chapter 179D "Dams and Reservoirs" of Hawaii Revised Statues, and Title 13, Subtitle 7, Chapter 190, "Dams and Reservoirs" of the Hawaii Administrative Rules.

These inspections were conducted under joint agreements of the U.S. Army Corps of Engineers (ACE), the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the State of Hawaii. The Memorandum of Agreement with the U.S. Army Corps of Engineers is entered into pursuant to 10 U.S.C. § 3036(d)(2), and the Intergovernmental Cooperation Act (31 U.S.C. §6505), and established via support agreement number DL-06-01.

III. Scope

Visual inspection was performed on parts of the embankment and appurtenant works readily available and visible for inspection by the inspection team at the time of the inspection. Such parts and appurtenant works included the upstream slope, crest, downstream slope, abutments and toes, outlet works, and spillway.

On the date of this limited visual inspection, there may or may not have appeared to be any immediate threat to the safety of the dam, however no assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

IV. Limitations of Findings and Recommendations

The inspection is based only on visible features/areas of the dam on the day of inspection. The inspection does not entail detailed stability, hydrologic, hydraulic, or seismic investigations. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies.

V. Inspection Team

Organization	Name
U.S. Army Corps of Engineers	Joseph P. Koester
State of Hawaii, Dept. of Land and Natural Resources	Eric Tanaka
National Resources Conservation Service	Drew Stout
State of Hawaii, Dept. of Agriculture	Ernest Alfonso

VI. Owner's Representatives Present

No owner representative was present at the time of inspection, however, Dr. Ka'eo Duarte of the Kamehameha Schools (owners) was briefed the day following on findings and recommendations.

VII. Summary Report Team

Organization	Name
U.S. Army Corps of Engineers	Derek Chow
	Joseph Koester
State of Hawaii, Dept. of Land and Natural Resources	Denise Manuel
	Edwin Matsuda

VIII. Dam Type

The dam is an earthen embankment.

IX. Dam Classification

The current hazard classification of this dam is: Low
Based on available data, this classification is believed to still be applicable.

Hazard Potential Classification based on the following:

Category	Loss of Life	Economic Loss
Low	None Expected	Minimal (undeveloped to occasional structures or agriculture)
Significant	Few (No Urban development and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry or structures)
High	More than a few	Extensive community, industry or agriculture.

Based on inventoried storage and height data, the size classification of the dam is: Small

Size Classification based on the following:

Category	Storage (Acre-Feet)	Height (feet)
Small	< 1000	< 40
Intermediate	> 1000 and < 50,000	> 40 and < 100
Large	> 50,000	> 100

Dam ID:	**HI00027**
Name:	**E-13 Reservoir**

X. Summary of Inspection:

Condition Rating Criteria: The conditional terms in this report are used to generally described the conditions below. Inspections, monitoring, and additional investigations are considered to be incidental to all condition ratings.

Satisfactory	Expected to fulfill intended function.
Fair	Expected to fulfill intended function, but maintenance is recommended.
Poor	May not fulfill intended function; maintenance or repairs are necessary.
Unsatisfactory	Is not expected to fulfill intended function; repair, replacement, or modification is necessary.
Unknown	Not visible, not accessible, not inspected, or unable to determine the condition rating based on the observation taken.

A. General appearance:

The reservoir and dam features were easily recognizable. The dam appears to have a small drainage area.

Modifications / Improvements: There were no signs of any recent modifications.
Based on staff personnel, this reservoir is not subject to flash flood conditions.
Based on staff personnel, this reservoir has no incident history.

Findings and Corrective Actions:

a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
b. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
c. Routine inspection logs were not inspected.
d. The dam did not appear to be maintained on a regular basis.
e. Access to site appears to be satisfactory.
f. Emergency Alarms / Monitors: There were no alarms or monitors observed on this reservoir.
g. Power / Communication: There were no communication systems observed on this reservoir. There were no utility or power poles visible nearby.

B. Access / Security:

Access to the dam was accomplished via a County roadway.
A four wheel drive vehicle is not required.

C. Inflow Works:

The inflow works were not inspected. However according to staff personnel, there is a ditch lined with a concrete half-pipe that formerly diverted flow from the Lower Hamakua Ditch that runs along the upstream boundary of the reservoir.

The intake or inlets may have the ability to be shut off; condition is unknown. The intake works were not inspected / tested.

D. Reservoir

The reservoir was dry during the inspection. An old, inoperable staff gage was attached to the valve stem that formerly served to control the intake, at the low level outlet on the upstream slope. According to staff personnel, the reservoir is kept open and is normally empty or low. No sinkholes or depressions were observed.

Findings and Corrective Actions:

a. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
b. The staff gage is inoperable, but repair is not recommended, as the embankment is nearly completely breached, as will be discussed later.

E. Upstream Slope (Fair)

The upstream slope was approximately 1-1/2 H: 1 V (Horizontal / Vertical). A fitted and grouted riprap rock slope protection was observed. Vegetation was observed growing between the rocks. Portions of the head of the upstream slope were not entirely visible due to heavy woody vegetation (Christmas Berry trees).

Findings and Corrective Actions:

a. The upstream slope appeared to be in fair to poor condition and requires corrective action (*unless the dam is to be completely breached*).
b. Slope protection needs maintenance or repair. Description: brush clearing.
c. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

F. Crest: (Satisfactory)

The dam crest was approximately 13 feet wide
There was a dirt access road on top of the crest that appeared to be well utilized.
There was woody high vegetation on either edge of the crest, especially the downstream side.

Findings and Corrective Actions:

a. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
b. Access along the crest was satisfactory.

G. Downstream Slope: (Fair)

The downstream slope was in fair condition; portions were not visible due to heavy vegetation. Slope was approximately 1-1/2 H: 1 V.
There was no slope protection observed on the downstream slope.
Some minor erosion, associated with feral pig trails, was observed on the downstream slope, however the slope was not entirely visible.
Vegetation was observed on the downstream slope. The majority of the vegetation was woody trees ranging from 4" to 1 ft in diameter.
Seepage was not observed on the downstream toe, however the slope was not entirely visible due to Christmas Berry trees.

Findings and Corrective Actions:

a. The downstream slope appeared to be in fair to poor condition and requires corrective action; if the dam is preserved from breaching, brush must be cleared.
b. Slope protection needs maintenance or repair.
c. Rut erosion was observed on the slope, associated with feral pig trails, which requires maintenance and/or repair if the dam is to be preserved.
d. Portions of the down stream slope were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
e. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

H. Abutments / Toe: (Poor)
The toe was not entirely visible or identifiable due to heavy vegetative growth.

Findings and Corrective Actions:
a. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
b. Rut erosion was observed, which requires maintenance and/or repair. Description: repair feral pig trails
c. The toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
d. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

I. Outlet Works: (UnSatisfactory)
The outlet works were not accessible at the upstream intake; it was apparent that the outlet works were not functional.
Heavy vegetation obscures filter boxes at the downstream end and should be removed and maintained low to enable easy visual inspection.
The outlet works appeared to be a low-level pipe of unknown size, through the center of the embankment.
The outlet works was originally controlled via a gate valve on the upstream side of the dam, but this equipment is no longer functional.
No seepage was observed near the exit of the outlet works from the dam.
The original access bridge to the upstream valve stem is in disrepair and poses a danger to anyone who may attempt to climb on it.

Findings and Corrective Actions:

a. The outlet works were not tested.
b. The original access bridge is an attractive nuisance and should be removed as soon as possible to avoid injury to curious visitors. Site access is not restricted.
c. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Corrective action is required if the dam is to be preserved.
d. Filter boxes at the downstream end of the outlet pipe were not clearly visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
e. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause severe damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include

removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

J. Spillway: (UnSatisfactory)

This spillway consisted of an unlined channel cut into the right abutment, at an angle of about 15 degrees to the embankment axis. This excavation leaves about 2 feet of freeboard to the bottom of the dry reservoir, acting as a near breach.
The spillway opening is roughly 40 ft wide.
The spillway channel then feeds a drainage swale that runs overland downstream, away from the embankment. Abandoned drip lines are seen in the downstream area, remnant of former sugar cultivation.
The spillway approach was clear.
There was no erosion observed near the spillway.

Findings and Corrective Actions:

a. The Spillway appeared to be in unsatisfactory condition and would not expected to fulfill its intended function.
b. If the reservoir is no longer needed, it is recommended to completely breach or remove the embankment to natural ground level.

K. Down Stream Channel: (Satisfactory)

The down stream channel appeared clear to overland flow.
This reservoir is not considered to have a high hazard potential.

Findings and Corrective Actions:

a. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.

XI. Additional Comments: There are no permanent structures at risk in the downstream area below the dam, according to Mr. Alfonso.

Original field inspection notes were scanned and are attached to this summary report. Included are several photos from the site visit to detail important features of the project, captioned to be self-explanatory.

Per e-mail dated 5/1/2006 12:57 pm from Joe Koester, USACE

Other studies conducted? Unknown

Current use of reservoir – abandoned? Abandoned

Reservoir:
An old, inoperable staff gage was present at the dam during the inspection, attached to part of the outlet control structure at its upstream end.
No gage is recommended; existing spillway cut essentially breaches the reservoir at or below the level of the outlet pipe.

Intake Works:
Size of pipe None observed; concrete ditch once diverted flow from the Lower Hamakua Ditch for irrigation of sugar cane; permanently closed off.
Control information. No diversion is made from the ditch.

Upstream slope:
A better comment would have been “fair to poor condition” regarding the upstream slope. The spillway breach was observed after the comment on the upstream slope was noted on the field form.

Downstream slope:
Accessible by two wheel drive vehicle, unpaved trail.

Outlet works:
Dry reservoir; no seepage

Comments:
The dam presented no threat at the time of the inspection.
The owner representative claimed that there are no homes downstream of the dam.

Per telephone conversation with Drew Stout on 5/16/2006 at 9:11 a.m. with Dayna Kawakami

Security issues. Access to the dam is restricted. There are two gates to get to the dam, and Ernest Alfonso has the key to the first gate.

PHOTOGRAPHS

Dam ID: HA-027
Name: E-13 Reservoir

View of E-13 Reservoir from dam crest, showing vegetation on upstream slope and dilapidated intake control access bridge (HA-027)

View along crest, showing woody vegetation on downstream slope (HA-027)

Dam ID: HA-027
Name: E-13 Reservoir

View of spillway channel through dam from crest. Fence follows channel geometry (HA-027)

Filter box at downstream terminus of outlet pipe. Flow is undetermined beyond this structure. Trees obscure the embankment toe (HA-027)

FIELD INSPECTION SHEETS

Dam ID: HA-0027
E-13 RESERVOIR

Vulnerability Index:
Extreme 1 | High 2 | Moderate 3 | Low 4

Inspection No:
Date: 4/6/06

STATE OF HAWAII - DLNR
DAM SAFETY INSPECTION SHEET

Inspection Type: Visual Dam Safety Inspection

Persons Present	Affiliation	Phone Number
JOE KOESTER	US Army Corps of Engineers	
DREW STOUT	NRCS	
ERIC TANAKA	DLNR	
ERNEST ALFONSO	DOA	

Weather Condition: ☐ Rain previous day ☐ Rainy ☐ Drizzle / Mist ☐ Cloudy/Overcast ☑ Partly Cloudy ☐ Sunny ☐ Dry

Comments:

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1. General: *(Information currently on file, update as required)*

Dam/Res. Name	E-13 RESERVOIR		
Owner	Kamehameha Schools		*(C002)*
Owner Contact	Mr. Kaeo Duarte	Owner Ph.	
Lessee		Lessee Ph.	
O & M Contractor		O & M Ph.	
Nearest Town	NONE	Latitude	20.0733 ° (decimal)
County	HAWAII	Longitude	155.4317 ° (decimal)
Tax Map Key(s)	(3)4-4-004:001		

Dam Status	A:	Hazard Potential	L:	Dam Size	
Year Completed	1928	Dam Length	600 ft.	Dam Height	17 ft.
Normal Storage	54 ac.ft.	Max. Storage	61 ac.ft.	Max. Surface Area	ac.
Drainage Area	mi.	Spillway Type		Max. Spillway Q	cfs

Owner owns land under dam facility:
Emergency Action Plan on file with the Department: NO
Reports on file with the Department: None on file.

LOWER HAMAKUA DITCH

Dam ID: HA-0027
E-13 RESERVOIR

Inspection No:
Date: 4/6/06

2. Questions for Owner's Rep.:

	Yes	No	Unknown	Comments
Construction Plans Available	☐	☑	☑	
Site / Facility Map	☐	☐	☑	
Operation & Maintenance Manual	☐	☑	☑	
Emergency Action Plan	☐	☑	☑	
Modifications / Improvements	☐	☐	☑	
Conduct Routine Inspections	☑	☑	☐	
Conduct Routine Maintenance	☑	☑	☐	
Vehicle access to site	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Access during heavy rains	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Access when spillway is flowing	☑	☐	☐	☐ Not accessible ☑ With Standard car ☐ Requires 4-Wheel Drive
Other Studies Conducted	☐	☐	☐	☐ Phase I ☐ Phase II ☐ Hydraulics ☐ Stability ☐ Hazard ☐ Seismic ☐ Other:
Incident History	☑	☐	☐	☑ Breached ☐ Overtop ☐ Slide ☐ Down stream Flooding ☐ Other: ~1959
Reservoir's Current Use	☐	☐	☐	☐ Sediment ☐ Irrigation ☐ Recreation ☐ Flood Control ☐ Drinking Water ☐ Power Generation ☐ Other:

Findings and Corrective Actions:

- ☑ a. The Owner shall maintain documentations including Construction plans, specifications, improvements, modifications, Operations and Maintenance Manuals and routine inspection logs for this dam facility.
- ☐ b. An Emergency Action Plan (EAP) is on file with the department, submit any updates as applicable.
- ☐ c. An EAP is required for High Hazard Dams. Submit an updated EAP for this facility.
- ☑ d. An EAP is recommended for all dams regardless of hazard class. Submit EAP if developed for the facility.
- ☐ e. Submit narrative and additional information detailing the improvements, modifications, and/or alterations at the dam site, unless covered by approved dam permit.
- ☐ f. Routine inspection logs were not inspected.
- ☐ g. Dam owners shall provide for routine inspection of the dam.
- ☑ h. The dam did not appear to be maintained on a regular basis.
- ☑ i. Access to site appears to be satisfactory.
- ☐ j. There is no vehicular access to the dam site. Operational and emergency plans need to reflect this deficiency or access provided.
- ☐ k. Access to dam is questionable during severe weather conditions and/or spillway overflows. Operational plans and emergency plans need to reflect this deficiency or access provided.
- ☐ l. Provide a detailed narrative of the incident, responses taken, and any damages incurred. Dam owners are required to promptly advise the department of any sudden or unprecedented flood or unusual or alarming circumstance or occurrences which may adversely affect the dam or reservoir.
- ☐ m. Submit current Operations and Maintenance Manual or Procedures for this dam / reservoir facility.
- ☐ n. Submit Site or Facility Map of this Dam which identifies the location of major features including outlet works controls and conduits.
- ☐ o. _____

Additional Requirements:

The following investigative study(s) are:

Required	Recommended	
☐	☐	Phase I Study
☐	☐	Phase II Study (Including ☐ Seepage ☐ Hydrology/Hydraulics ☐ EAP)
☐	☐	Hydrology and Hydraulics (including Probable Maximum Flood and spillway capacity)
☐	☐	Stability Analysis
☐	☐	Seismic Analysis
☐	☐	Hazard Classification
☐	☐	Other: _____

Dam ID: HA-0027
E-13 RESERVOIR

Inspection No: _____
Date: 4/6/06

Physical Dam Features: (Check All Applicable. Provide description of Items Observed and/or Take Photos. Indicate photo # in description.)

3. Reservoir:

Level during inspection 0 ft per _____ (gage / other)

Normal Operating Level/Range 0 ft per _____ (gage / other)

Description: _____

Typical Operation ☐ Spillway always flowing ☐ Kept within normal range ☑ Kept Empty ☐ Drained Daily ☐ Only filled by Storms

☐ Other: _____

Sinkhole in Res.: ☐ # Observed: _____ Size: _____ by _____ in. Deep ☐ Not Visible ☑ None Observed

Description: _____

Staff Gage: Description: _____

Findings:

- ☐ a. The reservoir was not inspected.
- ☑ b. The reservoir appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The reservoir appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The reservoir appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ e. The staff gage needs maintenance and/or repair. Description: _____
- ☐ f. A staff gage was not observed at the reservoir. Provide some method of quantifying the water level within the reservoir.
- ☐ g. A sinkhole was observed in the upstream reservoir. Conduct additional investigations and monitoring to identify the cause, risk and appropriate action.
- ☐ h. _____

Inflow

4. Intake Works Description:

☐ Number of Intakes 1

☐ Intake Culvert / Pipe

Size: _____ in. ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other _____

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other _____

☑ Ditch / Flume

Dimension: _____ (Size x Depth) Shape _____

Surface: ☐ Dirt ☐ Wood ☐ Concrete ☑ Lined w/ CONCRETE HALF-PIPE

Control: ☐ Gate ☐ Valve ☐ Flow can either be Shut off or Bypassed

From: ☐ Stream Diversion ☐ Pump ☐ Reservoir ☐ Other FORMERLY DIVERTED FROM LOWER HANNA RUN

Findings:

- ☐ a. The intake works were not inspected.
- ☐ b. The intake works were not tested. UNUSED AT PRESENT
- ☐ c. The intake works appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ d. The intake works appeared to be in fair to poor condition and requires corrective action.
- ☐ e. The intake works appeared to be in unsatisfactory condition, urgent corrective action is required.

Corrective Actions:

- ☐ f. The intake works needs maintenance and/or repair. Description: _____
- ☐ g. _____

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Date: 4/4/01

5. Upstream Slope: **(Typical Slope ± (½H : 1V))**

Slope Protection: ☐ None ☐ Dumped Rock ☑ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Liner _____ ☐ Other: _____
☐ Defect in Protection: Description: _____

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ # Observed: _____ Size: _____ and _____ Depth ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☐ Low Ground Cover ☑ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: PENETRATING GROUTED RIP RAP

Findings:

☐ a. The upstream slope was not inspected.
☐ b. The upstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.
☐ c. The upstream slope appeared to be in fair to poor condition and requires corrective action. CLEAR BRUSH
☐ d. The upstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☑ e. Slope protection needs maintenance or repair. Description: brush dense
☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description: _____
☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.
☐ i. The upstream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☑ j. Tree(s) were observed on the dam embankment. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ k. _____

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6. Crest: Approximate Crest Width: 13'

Access: ☐ None ☐ Walking Path ☑ Roadway, Surface / Width / Usage: DIRT, UNUSED

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☑ None Observed
Description: _____

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description: _____

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed
Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description: _____

Findings:

- ☐ a. The dam crest was not inspected.
- ☑ b. The dam crest appeared to be in satisfactory condition, no corrective actions are required at this time.
- ☐ c. The dam crest appeared to be in fair to poor condition and requires corrective action.
- ☐ d. The dam crest appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

- ☑ e. Access along the crest was satisfactory.
- ☐ f. Access along the crest was not possible. Description: _____
- ☐ g. Rut and/or Gully erosion was observed on the crest, which requires maintenance and/or repair. Description: _____
- ☐ h. A crack was observed on the crest, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
- ☐ i. A sinkhole was observed on the crest, which requires further investigation to determine the underlining cause. Repair and monitor the area.
- ☐ j. Portions of the crest were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
- ☐ k. Tree(s) were observed along the dam crest. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
- ☐ l. _____

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7. Downstream Slope:

(Typical Slope ± 1½H : 1V)

Access: ☐ lower roadway along toe ☐ roadway to outlet works ☐ walkway to outlet works ☐ None Observed

Slope Protection: ☑ None ☐ Dumped Rock ☐ Rip Rap ☐ Grouted Rip Rap ☐ Concrete

Erosion: ☐ Loose soil w/ little vegetation ☐ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed

Description: OCCASIONAL SLOUGHS BY CATTLE TRAFFIC / HOG TRAILS + DIGGING

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed

Description:

Sinkholes: ☐ _____ in. Wide x _____ in. Long x _____ in. Deep ☐ Not Visible ☑ None Observed

Description:

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☑ Trees # Numerous ☐ <6" ☑ >6" & <20" ☐ >20"

Description: CHRISTMAS BERRY TREES PREVASIVE ON SLOPE

Seepage:

Seep Spot Number 1

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed

☐ Flowing, Description:

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:

Description:

Seep Spot Number 2

☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description:

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:

Description:

Findings:

☐ a. The downstream slope was not inspected.

☐ b. The downstream slope appeared to be in satisfactory condition, no corrective actions are required at this time.

☑ c. The downstream slope appeared to be in fair to poor condition and requires corrective action. CLEAR WOODY VEG.

☐ d. The downstream slope appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☑ e. Slope protection needs maintenance or repair. Description:

☐ f. Rut and/or Gully erosion was observed on the slope, which requires maintenance and/or repair. Description:

☐ g. A crack was observed on the slope, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.

☐ h. A sinkhole was observed on the slope, which requires further investigation to determine the underlining cause. Repair and monitor the area.

☐ i. The down stream slope was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☑ g. Tree(s) were observed on the downstream slope. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.

☐ h. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ i. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.

☐ j. The slope was very steep, around a 1 to 1 slope, further study is required to verify slope stability.

☐ k.

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8. Abutments/Toe:

Erosion: ☐ Loose soil w/ little vegetation ☑ Rut (<6") ☐ Gully (>6" deep) ☐ Not Visible ☐ None Observed
Description: PIG TRAILS

Cracks: ☐ Parallel with crest ☐ Perpendicular to crest ☐ Slide visible ☐ Not Visible ☑ None Observed
Description:

Vegetation: ☐ None ☐ Low Ground Cover ☑ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"
Description:

Seepage:
Seep Spot Number 1
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☑ None Observed
☐ Flowing, Description:
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:
Description:

Seep Spot Number 2
☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed
☐ Flowing, Description:
Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:
Description:

Findings:

☐ a. The abutments/toe were not inspected.
☐ b. The abutments/toe appeared to be in satisfactory condition, no corrective actions are required at this time.
☑ c. The abutments/toe appeared to be in fair to poor condition and requires corrective action.
☐ d. The abutments/toe appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. Slope protection needs maintenance or repair. Description:
☐ f. Rut and/or Gully erosion was observed, which requires maintenance and/or repair. Description:
☐ g. A crack was observed along the abutments/near the toe, which requires further investigation to determine the underlining cause. Monitor the area and/or repair as required.
☐ h. The abutment/toe area was not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.
☐ i. Tree(s) were observed along the abutment/toe. Trees have been identified as the probably cause of piping failures, and can possibly cause sever damage to the embankment if they are uprooted during a high winds. Corrective action is required to remove the tree hazards from the dam. Acceptable remedies include removal of the tree and its root structure down to a 2" diameter and reconstructing the damaged embankment section. All repair work shall be accomplished as per the requirements of licensed geotechnical or structural engineer. Routinely monitor the damaged area for signs of settlement and seepage.
☐ j. Seepage/Ponding water was observed. Monitor and conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.
☐ k. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil from the embankment. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area.
☑ l. TOE INACCESSIBLE DUE TO DENSE VEGETATION

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9. Outlet Works:

Culvert / Pipe

Type / Size: ~~[illegible]~~, INACCESSIBLE U.S., LOW LEVEL OUTLET PIPE.

Culvert: ☐ Concrete ☐ Masonry ☐ unlined earth ☐ Other UNKNOWN

Pipe: ☐ DIP ☐ Corrugated Metal ☐ PVC ☐ HDPE ☐ Concrete ☐ Other UNKNOWN

Control Type: ☐ Gate ☐ Valve ☐ Other SCREW GATE, DOESN'T APPEAR FUNCTIONAL

Location: ☑ Control on Upstream side ☐ Control on Downstream side

Seepage: ☐ Green Vegetation ☐ Wet or Muddy Ground ☐ Ponding Water ☐ Not Visible ☐ None Observed

☐ Flowing, Description:

Water Clarity: ☐ Clear ☐ Some particles ☐ Muddy ☐ Other:

Description: ABANDONED FILTER BOX, CINDER BLOCK, AT D.S. END FOR FORMER CANE IRRIGATION (DRIP LINE) SUPPLY.

Findings:

☐ a. The outlet works were not inspected.

☐ b. The outlet works were not tested.

☐ c. The outlet works appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ d. The outlet works appeared to be in fair to poor condition and requires corrective action.

☑ e. The outlet works appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ f. Seepage/Ponding water was observed. Conduct further investigation to locate the source of water and extent of any possible hazardous or developing condition.

☐ g. Seepage was observed flowing and particles were observed to be removed by the flow. Take immediate action to stop the loss of soil. Conduct further investigation to determine the underlining cause and take corrective action. Monitor the area. Failures caused by seepage/piping along the outlet conduit are very common and are considered to be a dangerous situation.

☐ h. Were not visible due to high grass and bush vegetation. Clear high vegetation and maintain low to enable easy visual inspection.

☑ i. ACCESS BRIDGE TO LOW LEVEL VALVE AT UPSTREAM TOE IS COLLAPSING & DANGEROUS; DECOMMISSION

☑ j. REMOVAL AS ATTRACTIVE NUISANCE HAZARD

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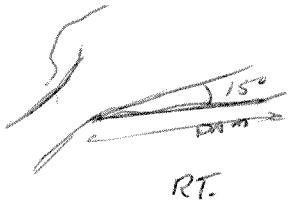

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10. Spillway:

Type: ☐ None ☐ Culvert/Pipe ☑ Channel RT. AT ABUT; 15° ANGLE W/ AXIS OF DAM

Description: APPEARS TO BE INTENTIONAL BREACH; WIDTH IMPOUND NO MORE THAN 3 FT.

Dimension: 4/0 AT TOP ft. Invert elevation: _____ ft. per staff gage

Slope Protection: ☑ None ☐ Grass ☐ Dumped Rock ☐ Fitted Rip Rap ☐ Grouted Rip Rap ☐ Concrete

☐ Defect in Protection: Description: _____

Approach: ☑ Clear ☐ High Veg. ☐ Trees ☐ Other: _____

Erosion: ☐ Scour ☐ Gully ☐ Headcut ☐ Not Observed ☐ Other: FERAL PIG TRAFFIC DEVEG.

Description: _____

Vegetation: ☐ None ☑ Low Ground Cover ☐ Bushes or Tall Grass ☐ Trees #_____ ☐ <6" ☐ >6" & <20" ☐ >20"

Description: TRAILS CUT BY PIGS

Findings:

☐ a. The Spillway appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ b. The Spillway appeared to be in fair to poor condition and requires corrective action.

☑ c. The Spillway appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☑ d. Slope protection needs maintenance or repair. Description: _____

☐ e. The spillway approach was blocked. Clear approach.

☐ f. Severe scour erosion was observed which requires maintenance and/or repair.
Description: _____

☐ g. A headcut (vertical drop in channel due to erosion) was observed downstream of the spillway. Corrective action is required to prevent this problem from moving upstream.

☐ h. Trees are unacceptable in the spillway channel and approach. Take corrective action to address the woody vegetation problem and repair the damaged area.

☐ i. Unclear if spillway is adequately sized. Spillway should pass the probable maximum flood. Verify spillway capacity and take corrective action as required.

☑ j. SEE DESCRIPTION

11. Down Stream Channel:

Name: _____

Downstream: ☐ Sump ☐ Open Area ☑ Un-Defined Drainage-way ☐ Defined Drainage-way ☐ Other _____

Items along Stream Bank: ☑ None ☐ Road ☐ Houses ☐ Town ☐ Not Inspected

Description: _____

Findings:

☐ a. The downstream channel was not inspected.

☑ b. The downstream channel appeared to be in satisfactory condition, no corrective actions are required at this time.

☐ c. The downstream channel appeared to be in fair to poor condition and requires corrective action.

☐ d. The downstream channel appeared to be in unsatisfactory condition and not expected to fulfill its intended function. Urgent corrective action is required.

Corrective Actions:

☐ e. _____

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Additional Comments:

On the date of this limited visual inspection, there appeared to be no immediate threat to the safety of the dam. No assurance can be made regarding the dam's condition after this date. Subsequent adverse weather and other factors may affect the dam's condition.

The spillway appears to be cut down to keep the pool drained, thus breaching the structure. Recommend completing breach at existing spillway. No blasting should be required; downstream channel is open, overland flow. No risk downstream to inhabited structures.

Limitations and Intent of this Dam Safety Inspection:

This Dam Safety Inspection was conducted to assess the general overall condition of the reservoir/dam, identify visible deficiencies, and recommend areas of for monitoring, additional investigative studies and corrective actions. The inspection is based only on visible features/areas of the dam on the day of inspection. This inspection is not a formal phase I or phase II dam safety inspection and does not include a review or evaluation from each specialist of an inspection team, such as a geologists, civil, geotechnical, structural, or hydraulics engineer. The owner should verify the findings of this report and take corrective actions. The owner may submit to the State alternative corrective actions that are certified by a licensed professional engineer in the State of Hawaii experienced in the design and construction of dams. This inspection does not relieve the owner/operator from their responsibility to conduct routine inspections, maintenance, repairs, modifications, monitoring, documentation, and/or investigative studies. The inspection was conducted under the authority of the Hawaii Revised Statures Chapter 179D, and Hawaii Administrative Rules, Title 13, Chapter 190, titled "Dams and Reservoirs". Questions regarding this inspection should be forwarded to the Hawaii State Dam Safety Program; PO Box 373; Honolulu, Hawaii 96809; Ph. (808) 587-0236.

Revised: Dec. 1, 2003